

## Gall-feeding habits in Lepidoptera of Japan. II: A cecidophagous stathmopodid moth attacking the gall of a tortricid moth on the Japanese mugwort

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**Abstract** The stem galls of *Eucosma metzneriana* (Treitschke) (Lepidoptera, Tortricidae) on the Japanese mugwort *Artemisia indica* var. *maximowiczii* were sampled at an urban park in Osaka, Japan and reared in the laboratory. The galls were fed on by the larvae of *Stathmopoda auriferella* (Walker) (Lepidoptera, Stathmopodidae). The attack rate was 9.4% ( $N=32$ ). The galls were heavily grazed and no adults of *E. metzneriana* eclosed from the attacked galls, suggesting that *S. auriferella* adversely affected *E. metzneriana*.

**Key words** Stem gall, facultative cecidophage, *Artemisia indica* var. *maximowiczii*, *Eucosma metzneriana*, *Stathmopoda auriferella*.

### Introduction

The Japanese mugwort *Artemisia indica* var. *maximowiczii* (Asteraceae) abundantly thrives in disturbed or early successional habitats in Japan such as roadsides, vacant lots, riverbanks, farmlands and orchards (Oki, 1997). Among herbaceous plants in Japan, *A. indica* var. *maximowiczii* harbors the most diverse gall-makers (see Appendix VII-1 in Yukawa & Masuda, 1996).

From the plant species which ubiquitously grow and are attacked by various gall-makers, cecidophages have frequently been found and recorded: Galls on *Quercus* and *Salix* trees are specifically fed on by various cecidophagous insects (Smith, 1970; Kopelke, 1994; Abe, 1995, 1997; Sugiura & Yamazaki, 2002; Sugiura *et al.*, 2002*a, b*; Yamazaki & Sugiura, 2003). To date, however, no cecidophagous insects from the galls on the Japanese mugwort have been reported.

We thus focused on the galls on *A. indica* var. *maximowiczii*, and found the larvae of a stathmopodid moth attacking the galls of a tortricid moth. In this report, the gall-feeding habit in the stathmopodid moth is recorded.

### Materials and methods

#### A galler moth on *A. indica* var. *maximowiczii*

*Eucosma metzneriana* (Treitschke) (Lepidoptera, Tortricidae) induces fusiform galls in the stems of *A. indica* var. *maximowiczii* (Kawabe, 1982; Nasu, 1998, Fig. 1). The eggs are laid singly on the underside of host leaves, the hatched larvae bore into the stems from terminal buds, and the galls are formed near stem apices with the stimulus of larval feeding (Nasu, 1998). This tortricid passes two generations per year, with adult emergence occurring both

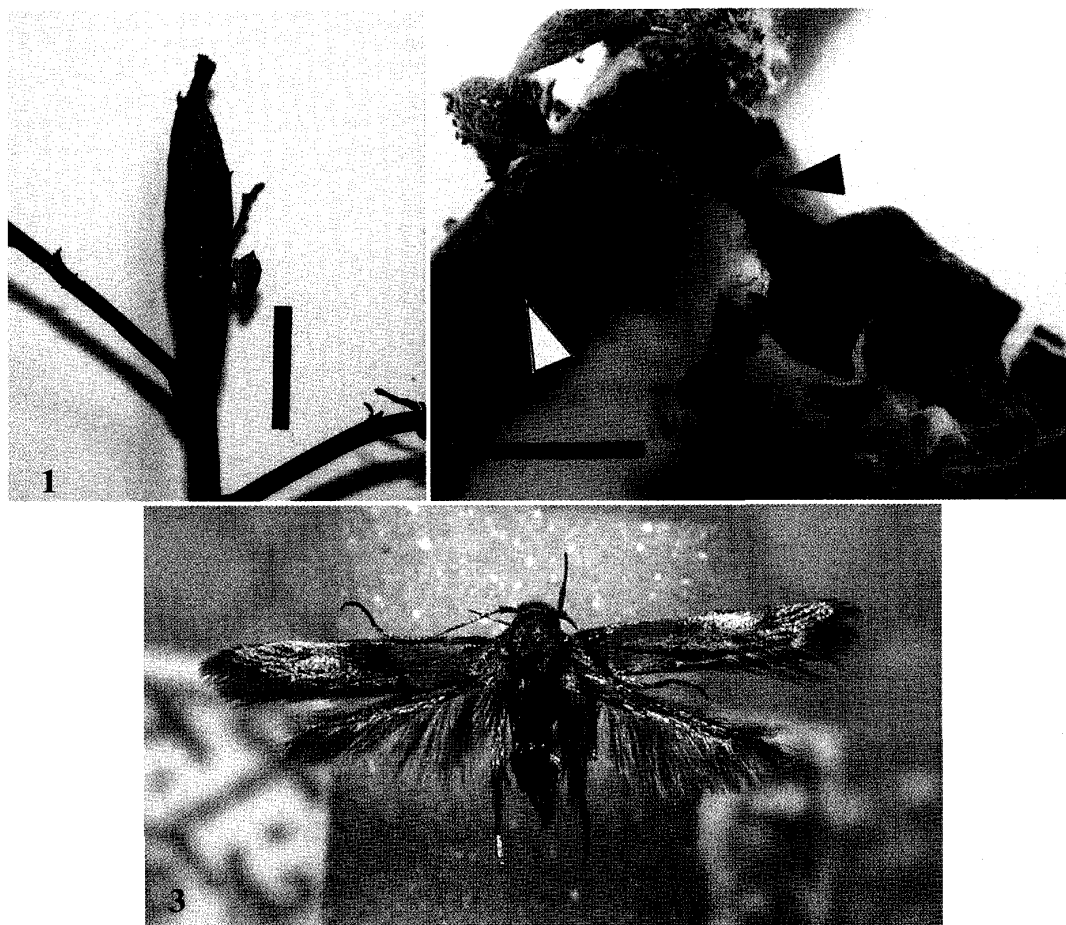


Fig. 1. A fusiform gall by *Eucosma metzneriana* in *Artemisia indica* var. *maximowiczii* stem. Scale bar: 10 mm.

Fig. 2. A larva of *Stathmopoda auriferella* (closed arrow) feeding on a gall by *Eucosma metzneriana* (open arrow). Scale bar: 10 mm.

Fig. 3. An eclosed female adult of *Stathmopoda auriferella* from a *Eucosma metzneriana* gall. Wing span: 10.2 mm.

in May and July in warm-temperate Japan (Kawabe, 1982; Nasu, 1998).

### Study site and methods

The galls of *E. metzneriana* were sampled at the Nanko Bird Sanctuary (34°38'N, 135°24'E, 0–5 m above sea level), Osaka City, central Japan. The Nanko Bird Sanctuary (19.3 ha) was founded in 1983 with a varied environment including ponds, marshland, and small hills to accommodate a wide array of avian species. *Artemisia indica* var. *maximowiczii* grows around the southern freshwater pond and the western saltmarsh together with yellow sweet-clover *Melilotus officinalis* (Leguminosae) and beach cocklebur *Xanthium italicum* (Asteraceae).

Thirty-two galls of *E. metzneriana* were cut off from the stems on 24 July 2002, placed in a plastic bag, and brought to the laboratory. The proximal ends of the galled stems were wrapped with moistened cotton, and then individually reared in plastic cups under 25°C, 16L: 8D. In the course of rearing, microlepidopterous larvae were found to feed on the galls. When the galls deteriorated, fresh leaves of the host plant were provided to these larvae. The

attacked galls were dissected with tweezers to inspect the inside of the galls after the eclosion of the moths.

## Results and discussion

From 3 out of 32 galls (attack rate=9.4%), microlepidopterous larvae other than *E. metzneriana* were individually found to feed on gall walls of *E. metzneriana* in the galls (Fig. 2). One male and one female of *Stathmopoda auriferella* (Walker) (Lepidoptera, Stathmopodidae) eclosed on 10 August and 24 September, respectively (Fig. 3). The rest of the larva unfortunately died of unknown causes.

The gall walls were heavily grazed by the larvae of *S. auriferella*. When the galls deteriorated, the stathmopodid larvae fed on host leaves. No adults of *E. metzneriana* eclosed from the three galls that were attacked by *S. auriferella*. These findings suggest that the stathmopodid exercises a negative effect on *E. metzneriana*.

*Stathmopoda auriferella* is well-known to infest flowers, fruits and leaves of many plants such as jujube, pomegranate, sunflower, avocado, mango, mandarin orange, peach, grape and Kiwi fruit (Moriuti, 1982; Park *et al.*, 1994). Therefore, the present study indicates that *S. auriferella* facultatively uses *E. metzneriana* galls for its larval food. Two aspects of adaptive significance of the cecidophagous habit in this stathmopodid can be proposed. Firstly, gall tissues are in general more nutritious than normal plant tissues (*e. g.* Mani, 1964; McNeill & Southwood, 1977). A larva of *E. metzneriana* (body length: ca 10 mm) completes its growth within a gall (diameter: 7–8 mm, length: 25–30 mm; Yukawa & Masuda, 1996), suggesting nutritious improvement of the gall compared with the normal stem tissue. Secondly, since this larva has a concealment habit as a borer, the gall may serve as a shelter.

Whether *S. auriferella* predate on the tortricid larva is unclear. The family Stathmopodidae comprises some predaceous species, whose larvae predate on scale insects, aphids, or spider eggs (Moriuti, 1982; Scoble, 1992; Pierce, 1995). The larvae of *Oedematopoda ignipicta* (Butler) (Lepidoptera, Stathmopodidae) predate on aphids on *Sasa* plants (Moriuti, 1982). Abe (1997) reported that the larvae of *Oedematopoda* sp. predate on the larvae of the gall wasp *Andricus mukaigawae* (Mukaigawa) (Hymenoptera, Cynipidae), although that is infrequent because the well-developed parenchymatous tissues protect the gall wasps from attack by the moths. Fourteen stathmopodid species (*Stathmopoda* and *Oedematopoda*) were listed as predators by Pierce (1995). There is a possibility that *S. auriferella* predate on *E. metzneriana* larva. Further studies are required to clarify the feeding habit of *S. auriferella* and its effect on *E. metzneriana*.

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## References

- Abe, Y., 1995. Relationships between the gall wasp, *Trichagalma serratae* (Ashmead) (Hymenoptera: Cynipidae), and two moth species, *Andrioplecta pulverula* (Meyrick) (Lepidoptera: Tortricidae) and *Characoma ruficirra* (Hampson) (Lepidoptera: Noctuidae). *Appl. Ent. Zool.* **30**: 83–89.
- , 1997. Well-developed gall tissues protecting the gall wasp, *Andricus mukaigawae* (Mukai-

- gawa) (Hymenoptera: Cynipidae) against the gall-inhabiting moth, *Oedematopoda* sp. (Lepidoptera: Stathmopodidae). *Appl. Ent. Zool.* **32**: 135–141.
- Kawabe, A., 1982. *Eucosma metzneriana* (Treitschke). In Inoue, H., Sugi, S., Kuroko, H., Moriuti, S. & A. Kawabe (Eds), *Moths of Japan* 1: 137; 2: pl. 28. Kodansha, Tokyo. (In Japanese.)
- Kopelke, J. P., 1994. The parasite complex (parasitic inquiline and parasitoids) of *Pontania* galls (Insecta: Hymenoptera: Tenthredinidae). *Senckenbergiana Biologica* **73**: 83–133 (in German with English summary).
- Mani, M. S., 1964. *Ecology of Plant Galls*. 434 pp. Dr Junk Publ., Hague.
- McNeill, S. & T. R. E. Southwood, 1977. The role of nitrogen in the development of insect-plant relationships. In Harborn, J. B. (Ed.), *Biochemical Aspects of Plant and Animal Coevolution*: 77–98. Academic Press, New York.
- Moriuti, S., 1982. Stathmopodidae. In Inoue, H., Sugi, S., Kuroko, H., Moriuti, S. & A. Kawabe (Eds), *Moths of Japan* 1: 256–258, pls. Kodansha, Tokyo. (In Japanese.)
- Nasu, Y., 1998. Olethreutine moth forming galls on the Japanese mugwort. In Yasuda, T., Hirowatari, T. & M. Ishii (Eds), *Biology of the Microlepidoptera*: 201–205. Bunkyo Shuppan, Osaka. (In Japanese.)
- Oki, Y., 1997. *Artemisia indica* var. *maximowiczii*. In Okuda, S. (Ed.), *Wild Plants of Japan*: 68. Shogakukan, Tokyo. (In Japanese.)
- Park, J. D., Park, I. J. & K. P. Han, 1994. Investigation of insect pests and injury characteristics of *Stathmopoda auriferella* (Walker) on Kiwi fruit tree. *Korean J. appl. Ent.* **33**: 148–152 (in Korean with English summary).
- Pierce, N. E., 1995. Predatory and parasitic Lepidoptera: Carnivores living on plants. *J. Lepid. Soc.* **49**: 412–453.
- Scoble, M. J., 1992. *The Lepidoptera: Form, Function and Diversity*. 404 pp. Oxford Univ. Press, Oxford.
- Smith, E. L., 1970. Biosystematics and morphology of Symphyta. 2. Biology of gall-making nematine sawflies in the California region. *Ann. ent. Soc. Am.* **63**: 36–51.
- Sugiura, S. & K. Yamazaki, 2002. Tortricid moths reared from cecidomyiid bud galls on willows. *Trans. lepid. Soc. Japan* **53**: 116–118.
- Sugiura, S., Yamazaki, K. & H. Ishii, 2002a. A record of a cecidophage from Lecithoceridae. *Trans. lepid. Soc. Japan* **53**: 12–14.
- Sugiura, S., Yamazaki, K. & T. Hishi, 2002b. A cecidophagous weevil, *Curculio albobittatus* (Coleoptera: Curculionidae), in the gall of *Pontania* sp. (Hymenoptera: Tenthredinidae). *Ent. Sci.* **5**: 193–196.
- Yamazaki, K. & S. Sugiura, 2003. Gall-feeding habits in Lepidoptera of Japan. I: Three different types of galls. *Trans. lepid. Soc. Japan* **54**: 31–39.
- Yukawa, J. & H. Masuda, 1996. *Insect and Mite Galls of Japan in Colors*. 826 pp. Zenkoku-noson-kyouiku-kyokai, Tokyo. (In Japanese.)

## 摘 要

日本の鱗翅目におけるゴール食の習性 2.—ヨモギのハマキガによる茎コールを攻撃するニセマイコガ (山崎一夫・杉浦真治)

大阪市南港野鳥園において、ヨモギクキツトフシ (トビモンシロヒメハマキ, *Eucosma metzneriana* (Treitschke)) によりヨモギ茎に形成されたゴールをサンプリングし室内飼育すると、キイロマイコガ, *Stathmopoda auriferella* (Walker) の幼虫がゴールを摂食しているのを確認することができた。ゴールのキイロマイコガによる攻撃率は 9.4% ( $N=32$ ) であった。ゴール壁は著しく食害され、それらのゴールからはトビモンシロヒメハマキ成虫は羽化しなかった。キイロマイコガはさまざまな果樹の花、果実、葉を食うことが知られていることから、機会的えい食者と考えられた。ゴールは質的に良好な食物およびシェルターとして利用されたのであろう。

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